SOLVENT LOSS MINIMIZATION

MSNLS-III

LS-III Solvent Summary for Top 5 Products

1) Fresh 30 KL. (28%)

2) Column Distilled 35 KL. (32%)

3) Plant Distilled 44 KL. (40%)

4) Target Saving Quantity 5 KL. (over all 5% of Fresh Consumption will be reduced).

5) Budget Requirement (After Discussion to be finalize)

6) Pay back

OPTIMIZING SOLVENT MANAGEMENT

Enhancing Efficiency & Sustainability at MSNLS-III

Key Areas:

- Loss Percentage
- Action Plan for Minimization
- In-House Recovery Usage
- Budget Requirements

Top 5 COMMERCIAL PRODUCTS AT LS-III

1)Clopidogrel Bisulphate

(CTPS1,COPB1,CGBH1,CGBH2)

2) Rosuvastatin Calcium

(RVST1)

3) Atorvastatin Calcium

(ATSC1,ATSC2,ATSC3)

4) Pregablin

(AMHA1,AMHA2,AMHA3(Crude),AMHA3 (Pure),PGBN7,PBLN4)

5) Levetiracetum

(LVTM2)

1) CLOPIDOGREL BISULPHATE

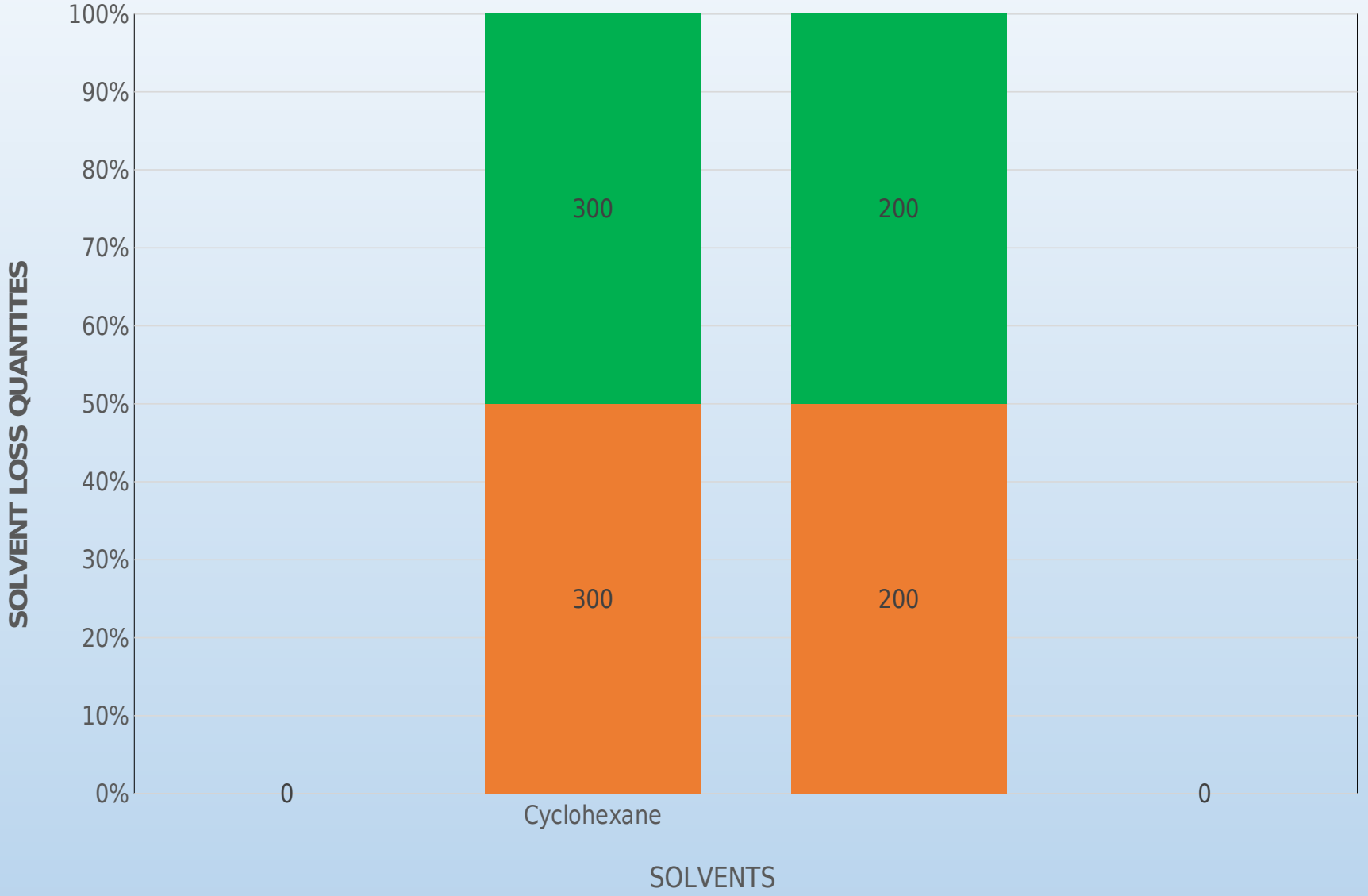
i) CTPS1-Input & Output Details

STAGE	SOLVENT USED	INPUT(Lts)	SPENT OUTPUT(Lts)	LOSS QTY (Lts)	LOSS PERCENTAGE(%)
CTPS 1	Toluene	1400	1200	200	14
	Cyclohexane	2200	1550	650	30

ii)Action Plan for Minimization

S.No.	Solvent	Predicted Losses	Action Plan
1	Cyclohexane	Distillation Loss	1) Chilled Utility connection is required to Primary condenser. 2) If required additional 6 m2 tertiary condenser is required to avoid further solvent loss.
		Filtration (ANFD)	1) Direct 2" SS304 line to be arranged from ANFD (C/ANFD/04) to Distillation Reactor (C/SSR/08) with out MLs receiver, to avoid multiple transfers. 2) Brine to be applied for collection reactor during filtration

CTPS1 EXISTING VS PROPOSED SOLVENT LOSS MINIMIZATION



i) COPB1-Input & Output Details

STAGE	SOLVENT USED	INPUT (Lts)	SPENT OUTPUT (Lts)	LOSS QTY (Lts)	LOSS PERCENTAGE
COPB1	Methanol(S-801)	2500	2000	500	20
	MDC(S-807)	2700	2080	620	23
	Methanol(S-801)	5000	4800	1584	32
	Acetone(S-805)	1080		576	53

ii) Action Plan for Minimization

S.No.	Solvent	Predicted Losses	Action Plan
1	MDC (S-807)	Transfer Loss (charging, work-up, pumping)	1) Closed transfer lines as per attached P&ID. 2) D/MDC charging line from C/SSRT/34 to C/GLR/05.
		Distillation Loss	1) Required Jacketed Receiver with cooling facility to avoid Distillation loss. 2) Tertiary condenser (6 m2) with Brine circulation. 3) Dedicated Dry Vacuum Pump is required for MDC Solvent in C-Block. 4) Vacuum Controlledr is required to avoid vacuum loss during initial vacum distillation

S.No.	Solvent	Predicted Losses	Action Plan
2	**Methanol + Acetone** (S-801+S-805)	Transfer Loss (charging, work-up, pumping)	Closed transfer lines as per attached P&ID. 1) D/MeOH + Acetone charging line with AOD Pump to C/SSR/03.
		Filtration	1) Direct 2" SS304 line to be arranged from ANFD (C/ANFD/02) to ML Distillation Reactor (C/SSR/17) with out MLs receiver, to avoid multiple transfers. 2) Brine to be applied for collection reactor during filtration.
		Distillation Loss	'Chilled water Utility connection is required to Primary condenser.

COPB1 EXISTING VS PROPOSED SOLVENT LOSS MINIMIZATION

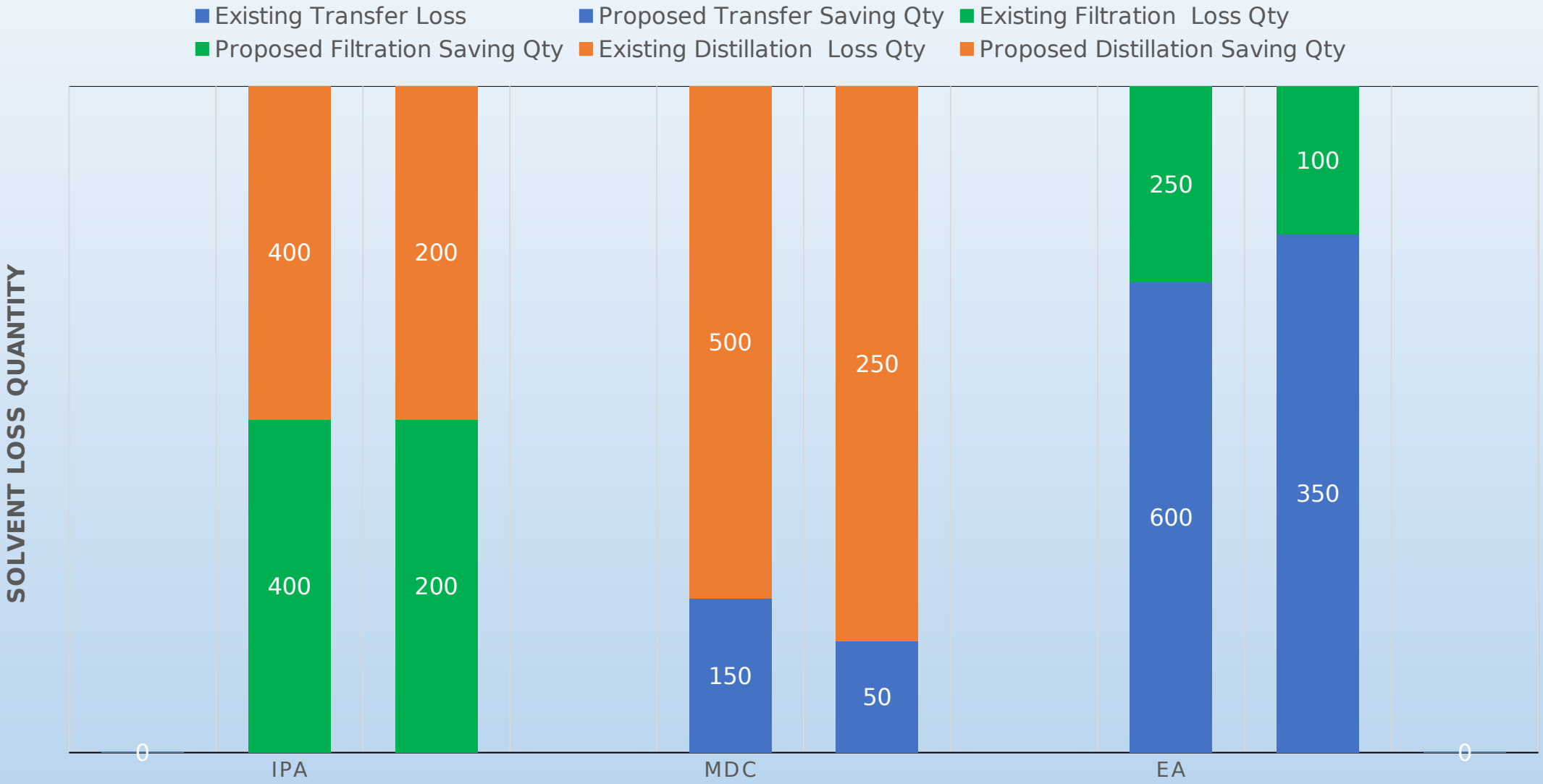
i) CGBH1-Input & Output Details

STAGE	SOLVENT USED	INPUT(Lt.)	SPENT OUTPUT(Lt.)	LOSS QUANTITY(Lt.)	LOSS PERCENTAGE (%)
CGBH1	MDC(S-807)	1600	1010	590	37
	Toluene(S-805)	2000	1900	100	5
	IPA(S-806)	2850	2200	650	23
	Ethyl Acetate (S-811)	3300	2200	1100	33
	Toluene(S-805)	2650	2100	550	21

ii) Action Plan for Minimization

S.No.	Solvent	Predicted Losses	Action Plan
1	**IPA** (S-806)	Filtration (Centrifuge)	1) 1) Nitrogen Blanketing system to be arranged for A/SSCF/03 & A/SSCF/04 (48") [inlet nitrogen flow regulator, Back pressure relief valve at vent & U-Seal in ML Line]. 2) 2) Otherwise Vent cendenser with ~ -50°C brine circulation required to collect the solvent from vent which is not economical.
		ML Distillation Loss	1) Chilled Brine Utility connection is required to secondary condenser. 2) During the flash distillation Reaction mass Temperatue to be increased upto 95°C instead of 87°C, to minimize the residue quantity.
2	MDC **(S-807)**	Transfer Loss (charging, work-up, pumping)	Closed transfer lines as per attached P&ID. 1) D/MDC charging line from C/SSRT/34 to C/GLR/05.
		Distillation Loss	1) Required Jacketed Receiver with cooling facility to avoid Distillation loss. 2) Tertiary condenser (6 m2) with Brine circulation. 3) Dedicated Dry Vacuum Pump is required for MDC Solvent

CGBH1 Existing Vs Proposed SOLVENT LOSS MINIMIZATION



i) CGBH2-Input & Output Details

STAGE	SOLVENT USED	INPUT(Lt)	SPENT OUTPUT(Lt)	LOSS QTY(Lt)	LOSS PERCENTAGE(%)
CGBH 2	Methanol(S-801)	750	6000	750	100
	Cyclo Hexane(S-836)	2000	1650	350	18
	Acetone(S-805)	2950	2200	750	25

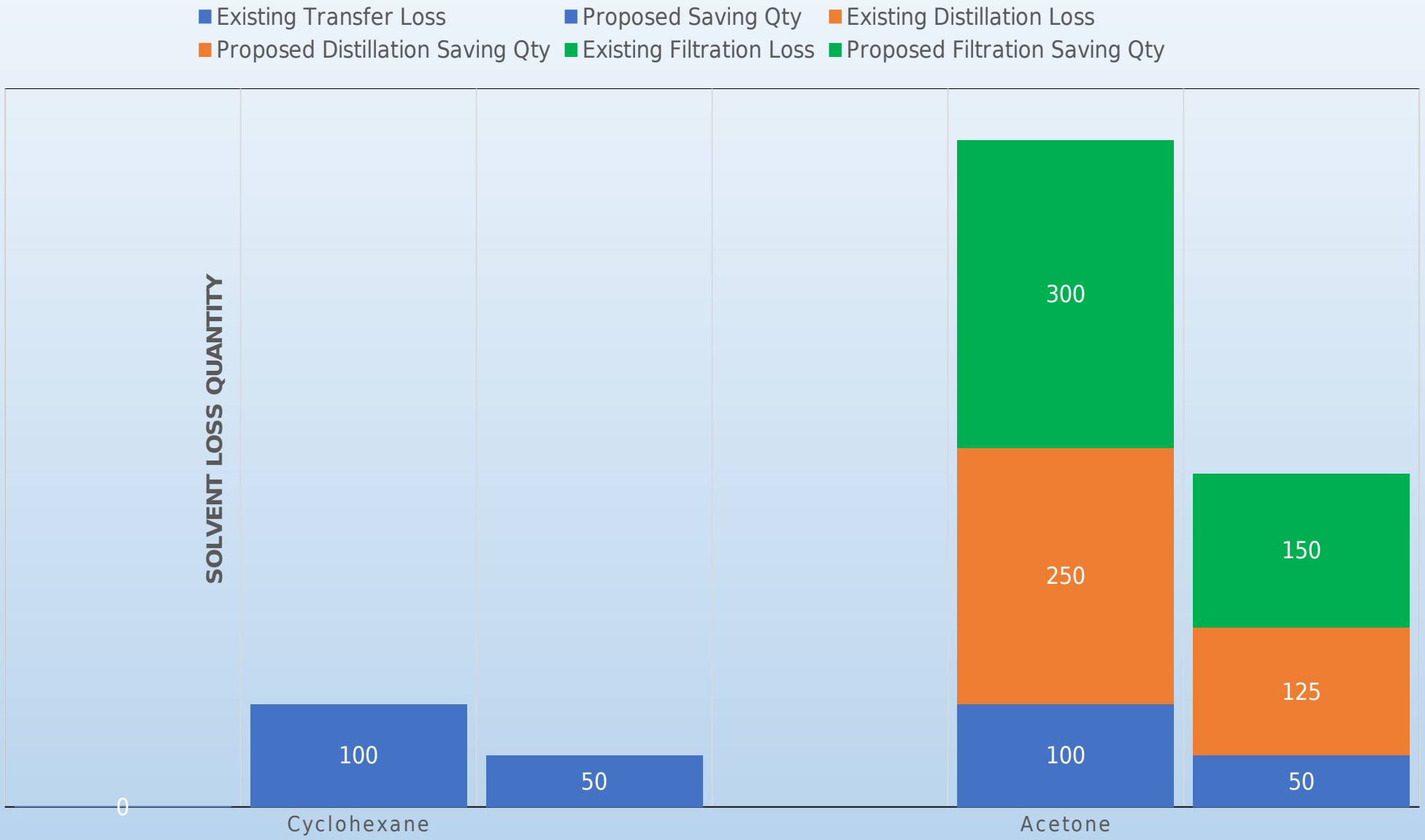
ii) Action Plan for Minimization

S.No.	Solvent	Predicted Losses	Action Plan
1	Cyclohexane (S-836)	Transfer Loss (charging, work-up, pumping)	1)Closed transfer lines as per attached P&ID. 2) D/MDC charging line from C/SSRT/34 to C/GLR/05.
		Distillation Loss	1) Required Jacketed Receiver with cooling facility to avoid Distillation loss. 2) Tertiary condenser (6 m2) with Brine circulation. 3) Dedicated Dry Vacuum Pump is required for MDC Solvent in C-Block. 4) Vacuum Controlledr is required to avoid vacuum loss during initial

ii) Action Plan for Minimization

S.No.	Solvent	Predicted Losses	Action Plan
2	Acetone (S-805)	Transfer Loss (charging, work-up, pumping)	1) Dedicated transfer line with Centrifugal pump required from Block to Tank Pad & Vice versa for reactor distilled & Column Distilled Acetonitril. 2) Dedicated transfer line with Centrifugal pump required from Centrifuge ML receiver to E/GLR/__.
		Filtration (Centrifuge)	1) Nitrogen Blanketing system to be arranged for E/SSCF/__ (48") [inlet nitrogen flow regulator, Back pressure relief valve at vent & U-Seal in ML Line].
		ML Distillation Loss	1) Brine circulation is required for primary condenser. 2) Tertiary condenser (4 m2) with Brine circulation.

CGBH2 EXISTING Vs PROPOSED SOLVENT LOSS MINIMIZATION



2)ROSUVASTATIN CALCIUM:

i) RVST1-Input & Output Details

STAGE	SOLVENT USED	INPUT(Lt)	SPENT OUTPUT (Lt)	LOSS QTY (Lt)	LOSS PERCENTAGE(%)
RVST1	Methanol(S-801)	1800	1900	106	100
	Ethyl Acetate(Crude)	3060	2550	510	17
	Iso Propyl Alcohol(Pure-1)	136	0	136	100
	Ethyl Acetate(Pure-1)	5400	4450	950	18

3)ATORVASTATIN CALCIUM

i) ATSC1-Input & Output Details

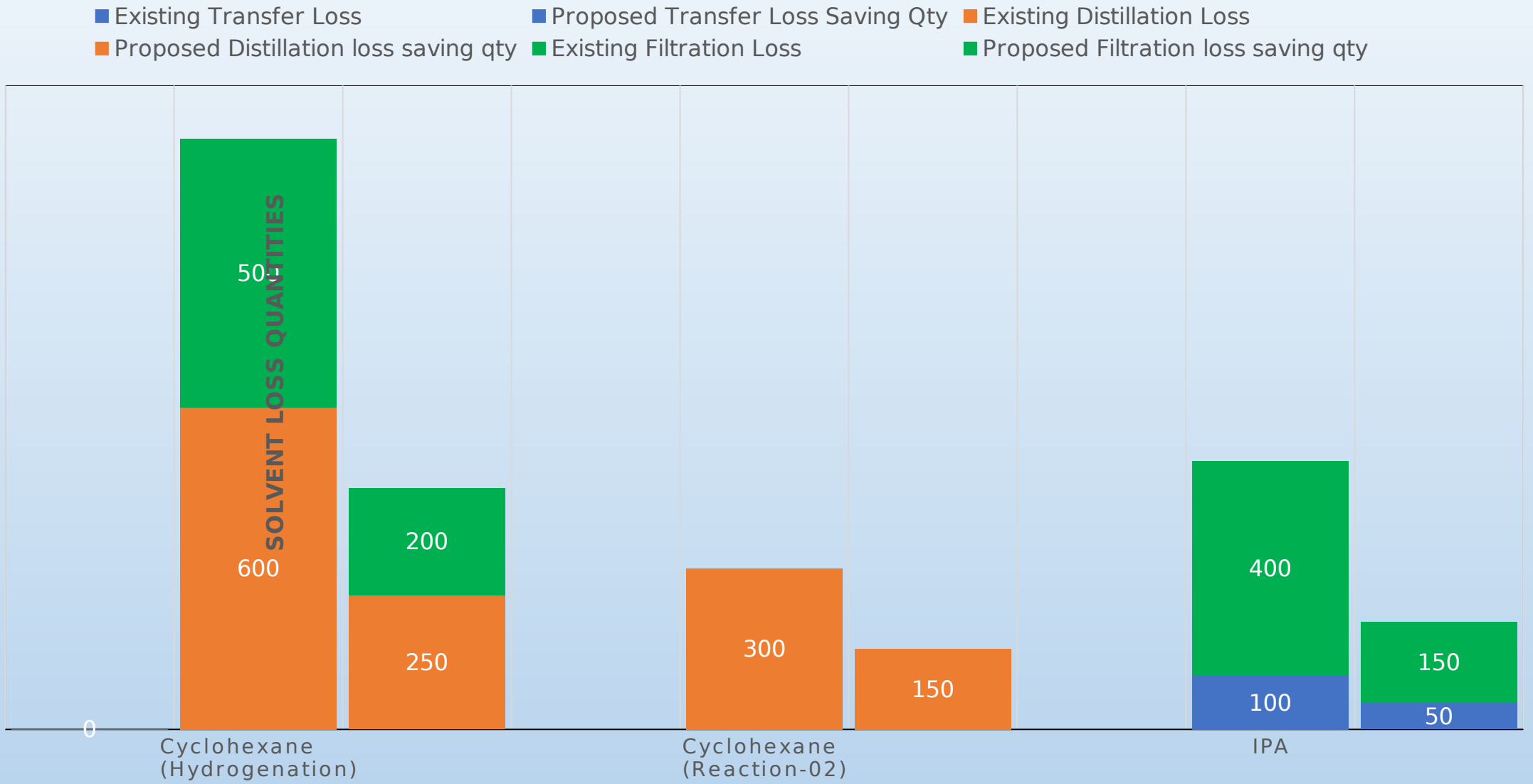
STAGE	SOLVENT USED	INPUT(Lt)	SPENT OUTPUT (Lt)	LOSS QTY (Lt)	LOSS PERCENTAGE(%)
ATSC1	Cyclo Hexane	4000	2700	1300	33
		1835	1480	355	19
		1835	1500	335	18
	Iso Propyl Alcohol	3300	2700	600	18
		3300	2750	550	17

ii) Action Plan for Minimization

S.No.	Solvent	Predicted Losses	Action Plan
1	Iso-Propyl Alcohol (S-806)	Transfer Loss (charging, work-up, pumping)	1) Dedicated transfer line with Centrifugal pump required from Block to Tank Pad & Vice versa for reactor distilled & Column Distilled Acetonitrile. 2) Dedicated transfer line with Centrifugal pump required from Centrifuge ML receiver to B/SSR/__.
		Filtration (Centrifuge)	Nitrogen Blanketing system to be arranged for B/HLCF/03 & B/SSCF/04 (48") [inlet nitrogen flow regulator, Back pressure relief valve at vent & U-Seal in ML Line].

S.No.	Solvent	Predicted Losses	Action Plan
2	Cyclo Hexane (Hydrogenation Reaction,S-836)	Transfer Loss (charging, work-up, pumping)	1) Dedicated transfer line with Centrifugal pump required from Distillate receiver to B/SSR/18 (Dissolution Reactor). 2) Pressure transfer required for Reaction mass transfer to hydrogenator.
		Catalyst Filtration (PNF)	1) Trial to be taken with another PNF (without perforated shell) to check the cycle time reduction & reduce solvent loss. 2) Dedicated Dry Vacuum Pump is required to collect solvent at vacuum pump to be used for distillation.
		Distillation Loss	1) Chilled Utility connection is required to Primary condenser. 2) Required Jacketed Receiver with cooling facility to avoid Distillation loss. 3) Tertiary condenser (6 m2) with Brine circulation. 4) Dedicated Dry Vacuum Pump (Above mentioned) and Vacuum Controller is required to avoid vacuum loss during initial vacuum distillation.
3	Cyclo Hexane (Reaction-2, S-836)	Transfer Loss (charging, work-up, pumping)	1) Dedicated transfer line with Centrifugal pump required from Distillate receiver to B/SSR/13/14 (Reaction Reactor). 2) Pressure transfer required for Reaction mass transfer to Isolation Reactor.
		Distillation Loss	1) Chilled Utility connection is required to Primary condenser. 2) Required Jacketed Receiver with cooling facility to avoid Distillation loss. 3) Tertiary condenser (6 m2) with Brine circulation.

ATSC1 Existing vs proposed solvent loss minimization



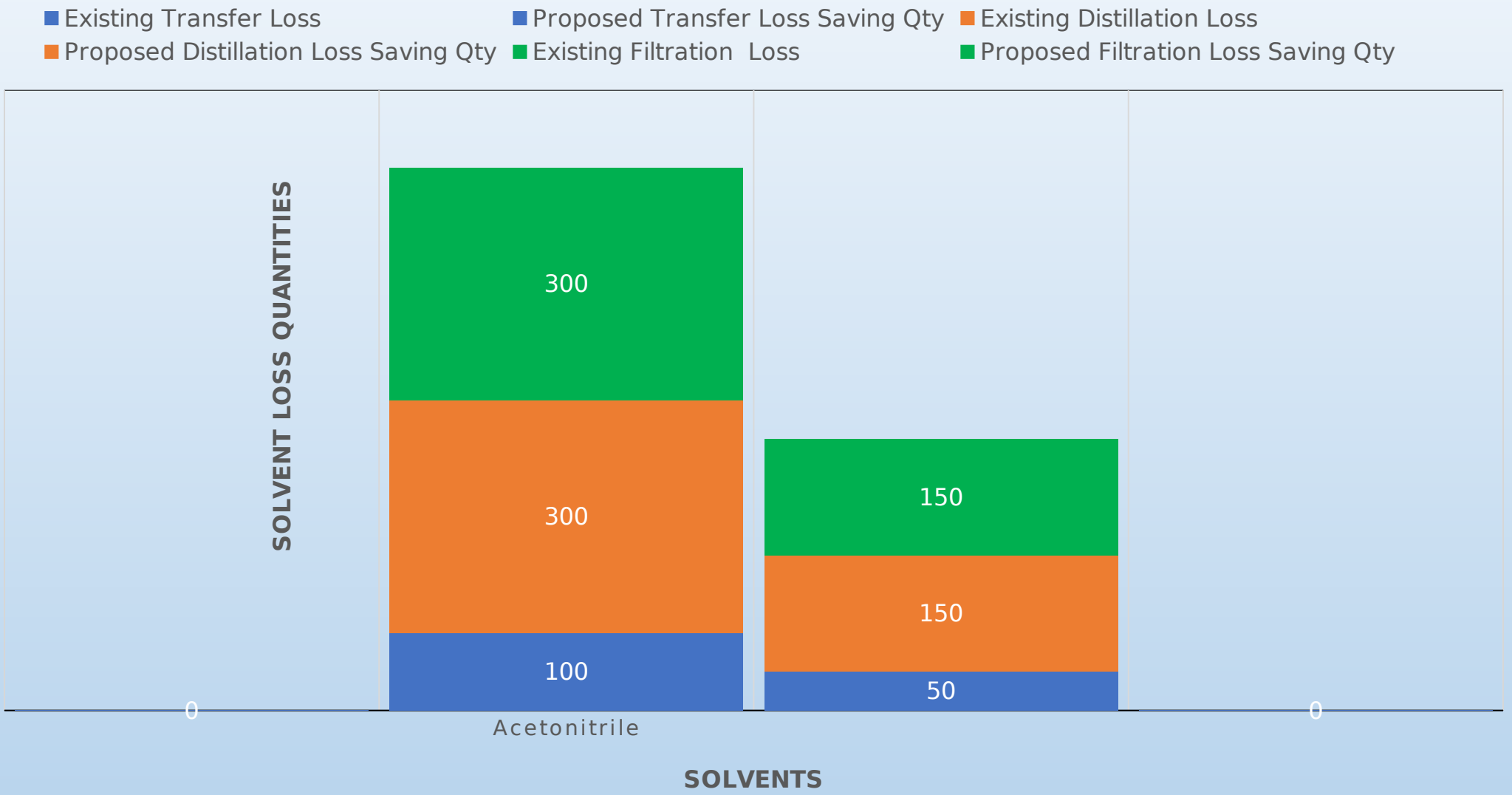
i) ATSC2,ATSC3 -Input & Output Details

STAGE	SOLVENT USED	INPUT (Lt)	SPENT OUTPUT (Lt)	LOSS QTY (Lt)	LOSS PERCENTAGE
ATSC2	Acetonitrile	2830	2700	130	5
	Iso Propyl Alcohol	143	0	143	100
ATSC3	Methanol	1360	3750	1360	100
	Toluene	3750	3300	450	12

ii) Action Plan for Minimization

S.No.	Solvent	Predicted Losses	Action Plan
1	Acetonitrile (S-810)	Transfer Loss (charging, work-up, pumping)	1) Dedicated transfer line with Centrifugal pump required from Block to Tank Pad & Vice versa for reactor distilled & Column Distilled Acetonitrile. 2) Dedicated transfer line with Centrifugal pump required from Centrifuge ML receiver to G/GLR/03.
		Filtration (Centrifuge)	1) Nitrogen Blanketing system to be arranged for G/SSCF/01 & G/SSCF/02 (60") [inlet nitrogen flow regulator, Back pressure relief valve at vent & U-Seal in ML Line].
		ML Distillation Loss	'1) As the ML pH is neutral, proposed to perform ML Distillation in SSR in place of G/GLR/17 for effective distillation & condensate collection.

Atsc2 existing vs proposed solvent loss minimization



4)PREGABALIN

STAGE	SOLVENT USED	INPUT(Lt)	SPENT OUTPUT(Lt)	LOSS QTY (Lt)	LOSS PERCENTAGE(%)
AMHA1	Methanol	3300	2000	1300	39
	Toluene	4400	4000	400	9
AMHA2	Toluene	7400	7000	400	5
	Ethyl Acetate	1800	1350	450	25
AMHA3 (Crude)	Toluene	800	700	100	13
	Methanol	800	680	120	15
AMHA3 (Pure)	Methanol	7600	5500	2100	28
	IPA	2700	2050	650	24
AMHA4	IPA	2700	2050	650	24

5)LEVETIRACETAM

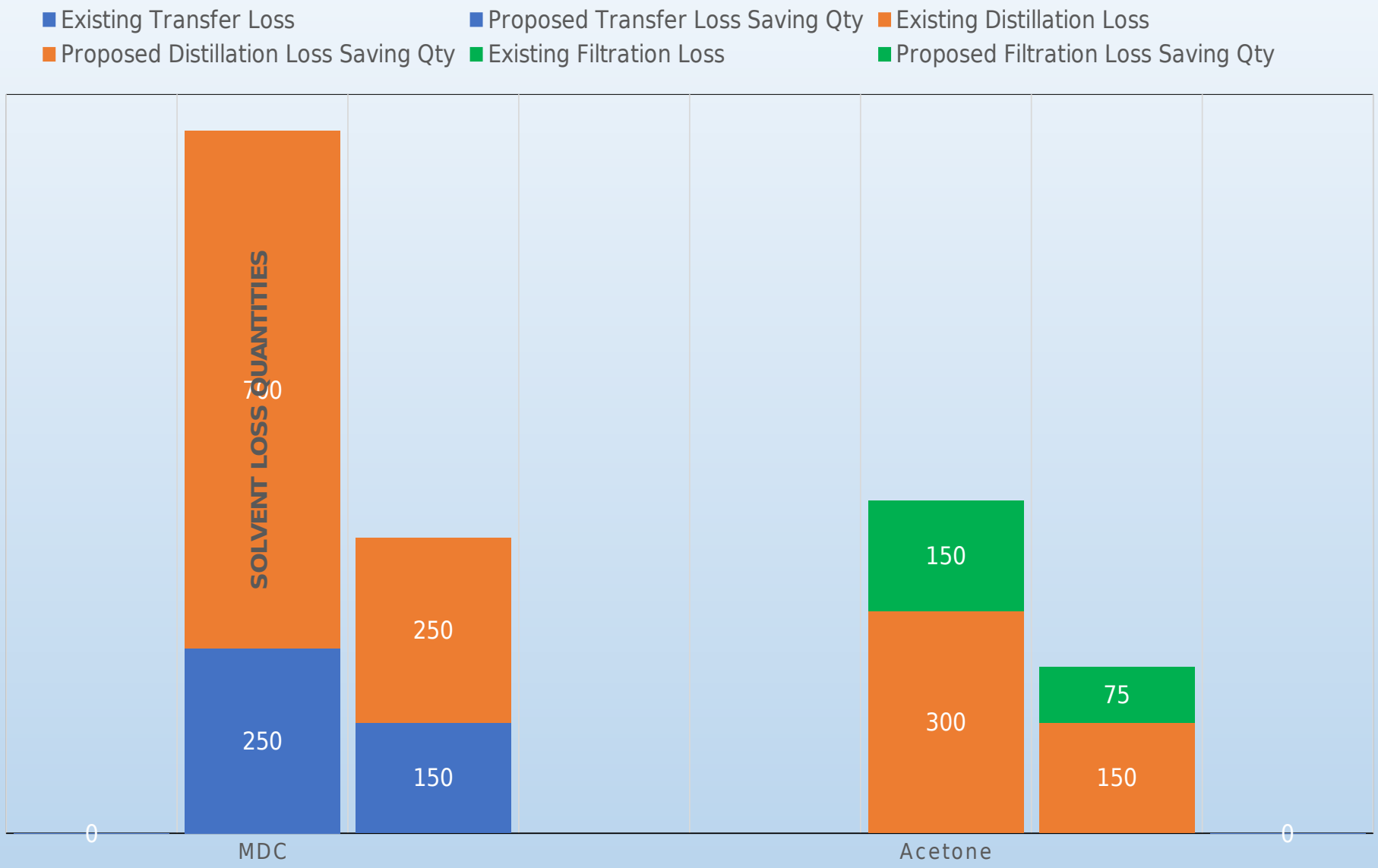
i) LVTM2-Input & Output Details

STAGE	SOLVENT USED	INPUT (Lt)	SPENT OUTPUT (Lt)	LOSS QTY (Lt)	LOSS PERCENTAGE(%)
LVTM2	MDC	8000	6165	1835	23
	Acetone	600	480	120	20
		900	600	300	33

ii) Action Plan for Minimization

S.No.	Solvent	Predicted Losses	Action Plan
1	MDC (S-807)	Transfer Loss (charging, work-up, pumping)	Dedicated transfer line with Centrifugal pump required from Block to Tank Pad & Vice versa for reactor distilled & Column Distilled MDC.
		Distillation Loss	1) Required Jacketed Receiver with cooling facility to avoid Distillation loss. 2) Tertiary condenser (6 m2) with Brine circulation for G/SSR/24. 3) Dedicated Dry Vacuum Pump is required for MDC Solvent in G-Block for G/SSR/24. 4) Vacuum Controller is required to avoid vacuum loss during initial vacuum distillation.
2	Acetone (S-805)	Filtration	1)Nitrogen Blanketing system to be arranged for G/SSCF/10 & G/SSCF/11 (60") [inlet nitrogen flow regulator, Back pressure relief valve at vent & U-Seal in ML Line].
		ML Distillation Loss	'1) Required Jacketed Receiver with cooling facility to avoid Distillation loss. 2) Chilled water Utility connection is required to Primary condenser.

LVTM2 EXISTING VS PROPOSED SOLVENT LOSS MINIMIZATION



Thank you!